

What is claimed is:

1. A semiconductor device comprising:

an insulating layer which is formed on a semiconductor substrate;

a conducting portion which is formed in said  
5 insulating layer; and

a modified layer which is formed between said insulating layer and said conducting portion,

wherein said insulating layer includes hydrogenated polysiloxane, said modified layer is a  
10 layer to which said hydrogenated polysiloxane is modified.

2. The semiconductor device according to claim 1, wherein a portion of said modified layer far from said semiconductor substrate is thicker than a portion of said modified layer near said semiconductor  
5 substrate.

3. The semiconductor device according to claim 2, wherein a portion of said conducting portion far from said semiconductor substrate is thicker than a portion of said conducting portion near said semiconductor  
5 substrate.

4. The semiconductor device according to claim 1, wherein said modified layer is a layer to which said

hydrogenated polysiloxane is oxidized.

5. The semiconductor device according to claim 1, wherein said hydrogenated polysiloxane includes at least one of a ladder type hydrogenated polysiloxane and a porous ladder type hydrogenated polysiloxane.

6. The semiconductor device according to claim 1, wherein said conducting portion is a wiring, and said modified layer is formed to attached to a side of said wiring.

7. The semiconductor device according to claim 6, wherein a portion of said conducting portion far from said semiconductor substrate is thicker than a portion of said conducting portion near said semiconductor  
5 substrate.

8. The semiconductor device according to claim 6, wherein said conducting portion includes:

a first conducting portion which is a bottom and side part of said conducting portion, and

5 a second conducting portion which is a remaining part of said conducting portion, made form copper.

9. A manufacturing method of a semiconductor device, comprising:

(a) forming an insulating film on a semiconductor substrate, wherein said insulating film includes  
5 hydrogenated polysiloxane;

(b) etching said insulating film to form a trench , wherein an etching gas including a fluorocarbon gas and an oxidant gas is used for said etching;

(c) forming an interconnection in said trench.

10. The manufacturing method of a semiconductor device according to claim 9, wherein said step (b) including:

(b1) transforming a part of said insulating film  
5 to a modified layer by using said etching gas, wherein said part of the insulating film is in a side wall of said trench.

11. The manufacturing method of a semiconductor device according to claim 10, wherein a portion of said modified layer far from said semiconductor substrate is thicker than a portion of said modified layer near  
5 said semiconductor substrate.

12. The manufacturing method of a semiconductor device according to claim 11, wherein said oxidant gas includes at least one of O<sub>2</sub>, CO and CO<sub>2</sub>.

13. The manufacturing method of a semiconductor

device according to claim 11, wherein said fluorocarbon gas includes at least one of  $\text{CF}_4$ ,  $\text{C}_4\text{F}_8$ ,  $\text{C}_5\text{F}_8$ ,  $\text{C}_2\text{F}_6$ ,  $\text{CH}_2\text{F}_2$  and  $\text{CHF}_3$ .

14. The manufacturing method of a semiconductor device according to claim 9, wherein a portion of said modified layer far from said semiconductor substrate is thicker than a portion of said modified layer near  
5 said semiconductor substrate.

15. A semiconductor device comprising:

a first insulating layer formed on a substrate;  
a trench formed in said first insulating layer;  
a conductive layer formed in said trench; and  
5 a second insulating layer formed between said first insulating layer and said conductive layer,  
wherein said trench has a part which is wider than the other part,

a thickness of said second insulating layer  
10 adjacent to said wider part is thicker than the other part.

16. The semiconductor device according to claim 15, wherein said trench has a width which is wider at upper part than lower part, and

a thickness of said second insulating layer  
5 adjacent to said upper part is thicker than a thick

ness of said second insulating layer adjacent to said lower part.